

SCIENCE

[Entered at the Post-Office of New York, N. Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XV. No. 378.

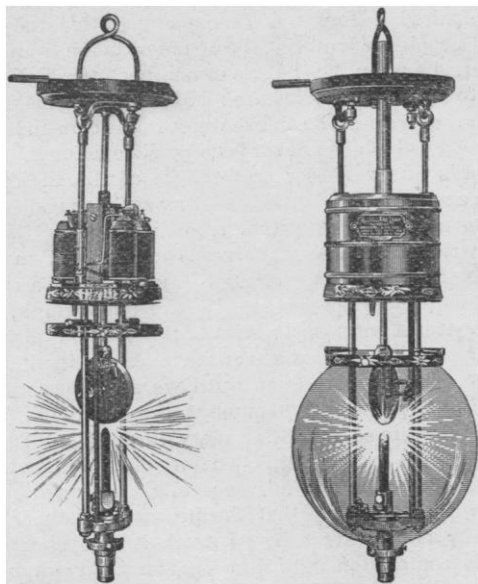
NEW YORK, MAY 2, 1890.

SINGLE COPIES, TEN CENTS.
\$3.50 PER YEAR, IN ADVANCE.

A SUPERIOR ARC-LAMP.

MANY efforts have been made by trained electricians and other experimenters, both in the United States and in Europe, to apply the disk carbon to the electric arc-lamp. every one appreciating how much more brilliant and lasting a light would be where the disk carbon was used rather than the ordinary pencil carbon, provided that it could be controlled. Until the present, all efforts in this direction, so far as made public, have ended in complicated and clumsy contrivances altogether unsatisfactory, and too expensive for general purposes in lighting.

The invention, of which we present illustrations, has for its object to provide an arc-lamp that will burn about twice as long without re-trimming as the arc-lamp now in general use, at a cost of constructing and operating not greater than that of the ordi-



THE RUSSELL DISK-CARBON ARC-LAMP.

nary arc-lamp. It consists in the combination of a vertically moving and intermittently rotating carbon electrode in disk form, with a pencil-shaped carbon electrode, fixed and immovable, standing vertically in the bottom of the lamp-frame. Arc-lamps as heretofore made burn about eight hours, when the carbons will be consumed; and if longer service is required, they must be renewed.

This lamp will burn and give a full light for about eighteen hours, and it may be so constructed as to burn twenty four hours before renewing the carbons. The cost of the carbons is less than the cost of those ordinarily in use in proportion to the amount of carbon in them. The electric current is less than that required by other arc lamps, as the length of carbon resistance is two inches less. The pencil being stationary, the disk is made to revolve slowly by the vibrations of the armature and the ratchet arrangement shown in the sectional view, and thus made to burn evenly around the centre. The disk descends a little lower after each rotation than it was during the previous rotation, and so on until

the disk is as nearly consumed as it may be. As the disk presents a greater surface of contact, a stronger and more steady light is secured; and over seventy per cent of the light is reflected below the disk, and not thrown above.

The lamp is provided with a device for arresting sparks, so that none can get outside the globe. It is known as the Russell electric lamp, and is attracting attention in Boston, where it is being introduced by the company controlling its manufacture.

ON THE USE OF THE PHONOGRAPH IN THE STUDY OF THE LANGUAGES OF AMERICAN INDIANS.

THE invention by Edison of the phonograph, and the improvements in its effectiveness which rapidly followed, naturally turned attention to the possibilities which it presents in the preservation of the languages of the aborigines of the United States. It was recognized independently by several persons, that, if the instrument could be brought to a certain stage of perfection, it would serve as a valuable means for this purpose; but no one, as far as the author knows, has published an account of experiments made to test its capabilities in this direction.

In order to determine its present value for this purpose, the author undertook a series of experiments,¹ taking for that purpose the language of the Passamaquoddy Indians, who are the purest blooded Indians now living in the confines of New England. The result of these experiments has fully justified his expectations, and convinced him that the instrument has now reached such a degree of perfection that it can be adopted by scientific students for that purpose. He believes that it is a most valuable auxiliary in linguistic researches, and that it should be used in the study of the fast disappearing languages of races, and in making record of those which are rapidly becoming extinct.

It is thought that phonetic methods of recording Indian languages are not all that might be desired for this purpose. Even with the assistance of the admirable system of letters and conventional signs which have been proposed for that purpose, there are many difficulties besetting the path of one who would accurately record the aboriginal languages, which are but imperfectly met by this method. There are inflections, gutturals, accents, and sounds in aboriginal dialects which elude the possibilities of phonetic methods of expression. It is desirable, also, to preserve songs, sacred and secular, which are rapidly becoming extinct. Their counting-out rhymes often have inflections which are imperfectly expressed by letters. The use of the phonograph among the Passamaquoddies has convinced me that the main characteristics of their language can be recorded and permanently preserved, either for study or demonstration, with this instrument.

On a visit to Calais, Me., undertaken in March, to make experiments on the value of the instrument in recording Indian languages, many cylinders full of records were taken. These embrace a large variety of subjects, such as it was thought would represent, in a general way, the main peculiarities of this branch of the Algonquin languages. The records taken may be roughly classed as follows: 1. Songs; 2. Folk-tales; 3. Pronunciation of

¹ The author read a paper on this subject before the American Folk-Lore Society at its last meeting in Boston on April 19. This paper will be published later. These experiments were carried on preparatory to taking the instrument for the same purpose among the Pueblo Indians of New Mexico. The work was done under the auspices of the Hemenway expedition.

words; 4. Passamaquoddy equivalents of English words; 5. Counting-out rhymes; 6. Imitations of sounds made by animals; 7. Ordinary conversations in the Indian language, in which two or more persons took part. These records were always accompanied by a statement on the cylinder of the subject, time and place, name of the Indian giving the testimony and that of the observer. This safeguard seemed necessary for future identification, as their labels might be displaced or lost, and by that means their value be impaired.

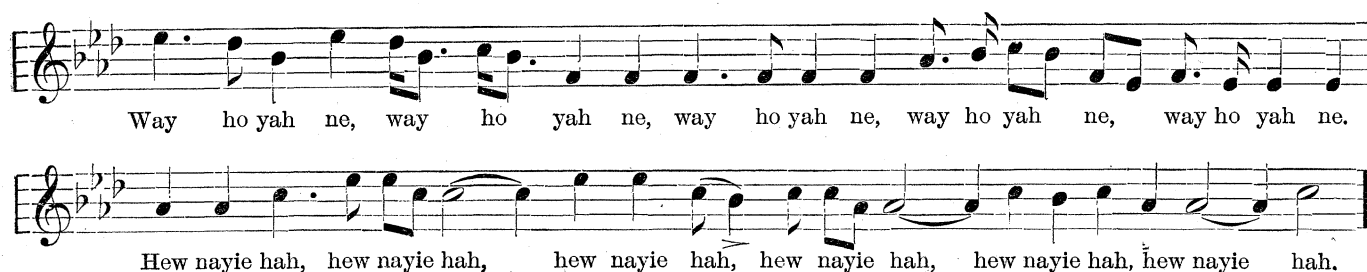
Among the songs¹ recorded are war-songs, a sacred song ("The Song of the Snake-Dance"), and several songs which form a part of ancient stories. It is said that in old times, as so often happens among primitive peoples, the folk-tales and legends were all sung. In many instances at the present time these stories have for the most part lost that character, and are simply narrations, although in many of them songs occur, and some still have a lyrical character. As an example of a story with songs in it, may be mentioned an interesting account of the adventures of Black Cat ("Pogump") and the Toad Woman ("Pookjinquess"), a story which is full of rude imagery, in which occurs a very old song with onomatopœic sounds. The so-called war-songs, which still survive in the memories of the old Indians, seem particularly desirable for preservation. One of these, a Mohawk war-song, the words of which were improvised, is of a most interesting character. The song sung at the celebration of the chief on the first night of the festivities was taken from the lips of the Indian who sung it the last time this event was celebrated.

Of sacred songs, the only one which was obtained is the song of the snake-dance, a little-known ceremony, which will be described in a forthcoming article in the *American Journal of Folk-Lore*. This dance, which has lost whatever sacred character it once had, has not been performed by the Passamaquoddies for five years, and the song was sung at that time by Noel Josephs, who sang it on the cylinder of the phonograph for me. All the listeners, of whom there were several, said that the song was very ancient. The words of the song as sung are as follows:—

"Way ho yāh ne, way ho yāh ne, way ho yāh ne, way ho—o—o,
Hew nayie hah, hew nayie hah, hew nayie hah."

These words are said to be archaic, which fact is regarded as additional evidence of the great age of the song itself, and were obtained by me from a study of the cylinder of the phonograph upon which it was recorded. When compared with the original, it shows how accurate the records are. The words of the song, which have been indicated by the spelling given above, were also derived from the phonograph. They were sent to Mrs. W. Wallace Brown of Calais, Me., who is one of the best students of the Passamaquoddy language known to me; and she writes me that she regards them as indicating the pronunciation as nearly as possible by phonetic methods.

The music of the "Snake-Dance" given below was written out by Mrs. H. E. Holt. Mrs. Holt had never heard the Indians sing the song, but was able from the record to write out the notes, from which a third person sang the song in the same way as the original recorder, Noel Josephs.



The first part of the song is sung by the conjurer, who goes about with a rattle while singing, searching for the snake, keeping

¹ It would be desirable to apply the phonograph to the preservation of other songs which are rapidly becoming extinct. For instance, it is said that the old plantation melodies of the negroes are rapidly being replaced by other songs. These might be recorded on the phonograph for permanent preservation.

time to the music by a dance. The second is the song of the Indians who take part in forming the coil which represents the snake. Calls to those not taking part in the dance frequently occur in the second part of the song, but those are not indicated. On the same cylinder with the music of the "Snake-Dance" I was able to obtain in the Passamaquoddy language a record of the proclamation announcing the dance, and an invitation to the same.

The possibilities of the phonograph in these studies indicate one of the great advantages of this instrument. What specimens are to the naturalist in describing genera and species, or what sections are to the histologist in the study of cellular structure, the cylinders made on the phonograph are to the student of language. In the quiet of his study he can hear the song repeated over and over again as often as he wishes, and can, so to speak, analyze it, and in that way separate the constituent sounds. Moreover, these records on the cylinders can be submitted to specialists for study. The collector may not have a musical ear, as in my own case, and may not be able to write out the songs, no matter how many times they are repeated. He can in that case collect the records, and submit them at some favorable time to one who is able to catch the song and set it to music.

It is particularly desirable to record the songs of the Indians, for we may conclude that these are very ancient, and preserve their identity for a long time. This is true at least as regards those pertaining to sacred observances, which may be regarded as of great antiquity. Songs in sacred ceremonials are among the last of the religious observances to be modified or changed. Paraphernalia of sacred dances, or even the whole sacred character of the dance, may be lost; but the song would be the last to have its integrity impaired. Moreover, when a comparative study of songs of different peoples is desirable, the cylinders taken from one tribe may be carried among the Indians of another in order to compare records or to see if those taken are recognizable. This method of comparison renders possible an exactness in the comparative study of Indian songs which has never been possible before.

The records of the stories or folk-lore of the Indians which were taken can be studied in the same way as the songs. Although the cylinders remain as perpetual records of the stories, it is desirable to write out the Indian words and obtain an accurate translation. I have gone far enough in my work to see that this can be done with great precision with the phonograph, and that the instrument has great capabilities in this method of work.

The study of folk-lore can never stand on a scientific basis as far as Indian tales are concerned until we reduce to a minimum the errors of interpretation which may creep in through the translator. The tales are so full of imagery that the tendency to enlarge upon them is fascinating, and names of well-known authors who have succumbed to this influence might be mentioned. As long as there is a possibility that the hearer adds to or detracts from the story as he hears it, by so much is the value of a story for scientific comparison diminished. The phonograph records the story exactly as the Indian tells it; and although free translation of it may, and probably must, be made, to render the story comprehensible, we can always preserve the phonographic record

as a check on exaggeration, or as a reference in critical discussions of the subject-matter of the story. In this way the phonograph imparts to the study of folk-lore, as far as the aborigines are concerned, a scientific basis which it has not previously had, and makes it approximately accurate.

In order to determine the pronunciation of Passamaquoddy

words, I took on the phonograph several cylinders, with the Indian equivalent of the English words. In doing this I made use of pages of the well-known schedules published by the Bureau of Ethnology at Washington, speaking the English word, and requesting the Indian to follow with the Passamaquoddy translation. This, of course, is only possible when the Indian has a knowledge of English, or is able to know by signs what is needed.

To obtain sentences, a conversation was recorded in Indian language between two Passamaquoddies. These cylinders reveal the general linguistic peculiarities, and when studied might be valuable adjuncts in the acquirement of the language.

It seems possible that the phonograph may be found to be of valuable assistance not only in the study of Indian, but also of all modern languages. A number of cylinders with records of sentences pronounced by a Frenchman or German with the proper accent might be found a valuable aid to a teacher of these languages who is not a native of the land the language of which he is teaching. Even proficient teachers might find it a help in their classrooms. For study of these languages without the aid of a teacher, a set of cylinders with the proper pronunciation might have a great value in training the ear to the correct pronunciation of the words and sentences of a foreign language, which are but imperfectly indicated by phonetic methods. By the use of the phonograph the teacher of modern languages might be relieved of the endless repetition of pronunciation of words in a foreign language which the pupil acquires with difficulty.

I have taken the following clipping from a daily paper: "Edison's phonograph has found a new application at the Milwaukee College, where it will be used as an assistant in teaching the French and other foreign languages. The phonograph, of course, never gets tired, and can be made to repeat the same sentence or the same word hundreds of times. In giving a lesson, the teacher reads it before the phonograph, at the same time addressing the pupils, and the lesson is reproduced whenever wanted." This would seem to indicate that the use of the phonograph in the teaching of modern languages had been put in practical test.

The necessity of work with the phonograph in preserving the languages of the aborigines of this continent is imperative. There are stories, rituals, songs, even the remnant of languages which once extended over great States, which are now known only to a few persons. These persons are in some instances old men and old women, with whose death they will disappear forever from the face of the earth if some record is not now made of them. Many have already been lost forever, even in the last twenty years, and some are fated to disappear in the next decade.

These rituals are in some instances the unwritten history of the tribe, and contain all that the Indians know of their history. The younger men among several tribes do not willingly take to the customs of their fathers. They are rapidly losing their former character. They have no desire to commit to memory the rituals of their ancestors. To learn their language, to live among them and study all that pertains to them from an intimate acquaintance, even membership in the tribe, is desirable, if earnest investigators can be found to undertake it; but this is not always possible. The phonograph renders it practicable for us to indelibly fix their languages, and preserve them for future time after they become extinct or their idiom is greatly modified or wholly changed.

The prime object of the above-mentioned experiments was simply to test the capabilities of the phonograph in recording aboriginal languages. That it could be used for that purpose was assured before I began by the knowledge that it records any language with precision; so that the experiments bearing on its capabilities in this direction might seem superfluous. Demonstration, however, gave weight to belief.

The expense at the present time for the use of the instrument is possibly a practical difficulty, which it is to be hoped may be lightened for those using the instrument for scientific purposes. Certainly no idea could show a more disinterested personal interest than a wish to permanently preserve the fast vanishing languages of the American Indians. It belongs to the realm of pure science, and the scientific student will probably be met in a similar liberal spirit by those who control the patents of the phonograph.

J. WALTER FEWKES.

FACTS ABOUT TORNADOES.

THERE is no subject in the whole science of meteorology of such absorbing interest as this of tornadoes. Its importance may be judged from the hundreds of pages that have been written upon it, from the universal attention paid it by newspapers through the length and breadth of the land, and from the fact that many insurance companies have taken the matter in hand, and are prepared to take tornado risks. It is easy to see that the interest in this topic must gradually increase as the tornado districts become more thickly populated, and as the facilities for spreading the news of disaster become greater. There is no doubt that in many instances losses from a tornado have been greatly exaggerated, and fears of devastation have been increased because pictures of the very worst tornadoes are the only ones that have been printed.

The most important thing for us to do is to establish the facts, and these will serve as a basis from which we may uproot false theories, and, if not now, at some time in the future, to build up a solid superstructure. It is to be noted that all studies on this question ultimately turn to the facts, either to support theories or to form them. We shall find the most diverse views in these discussions, and yet every one of them based upon facts. It is only because of a false or imperfect interpretation of what is observed that such antagonism can exist. A partial explanation of these conflicting views lies in the fact that the outburst of a tornado is accompanied by such terrifying manifestations, and observers are in such fear for their lives that they are totally unfitted to give an account of what they have seen. In many cases, also, there has been altogether too narrow a view taken of this phenomenon. We have been entirely absorbed in the immediate destruction, the demolition of houses, the twisting-off of trees, the distribution of *débris*, etc., and have neglected the atmospheric conditions which have led up to the disaster. All will agree that a thorough knowledge of all the circumstances attending these outbursts is indispensable, if we would learn the mechanism of a tornado, or if we ever attempt to guard against its devastation, or ever try to give warning so that others may protect themselves. We may enumerate some of the facts as follows:—

Quiescent State of the Atmosphere.

It is quite well known that tornadoes seldom occur singly, but many are formed over an extended region, five hundred or more miles in length and breadth, where the conditions are favorable for their development. In this region the air is remarkably quiet previous to the tornado. There is a general or wide-extended storm some two hundred or four hundred miles to the north-westward; and into this storm, which is usually intensified much above the average storms at that season, gentle southerly and south-easterly winds are blowing at a distance, which are freshened as the centre is approached. Tornadoes rarely occur in any but the hotter season, say from April to August; and in this season, even when there are thunder-storms, high winds are an exception.

Temperature.

The universal testimony is, that there is an exceedingly warm and sultry air. Even if the sky be overcast, and the

sun's direct rays be hidden, this same oppressive feeling is noted. This heat seems to have a special characteristic entirely unlike that from the ordinary bright sun's rays, and it has never been properly accounted for. The same heat is often felt just before a thunder-storm, and we may consider that the same cause is acting in both these cases.

Clouds.

The clouds have the general motion that they always have in the neighborhood of an extensive storm. This would seem an exceedingly important consideration, and would show that the conditions leading up to the tornado are the same as are present at innumerable times when there are no serious outbreaks. A beginning in a study of these conditions has already been made (*Journal of the Franklin Institute*, July, 1888, p. 48). In that investigation it was learned that near the centre of the general storm, the clouds moved mostly with the surface winds, from right to left, or counter-clockwise, and if they had any other direction it was simply a slight turning toward the east in the line of the general flow of the upper current. This fact was also ascertained by Hildebrandsson in Denmark, though the storms there may have slightly different characteristics from the proximity of the ocean. A score of tornado regions have shown this tendency. It will suffice to give here illustrations from three tornadoes which have been specially studied; and a fourth will be described later, in connection with the Louisville tornado.

Washington Court-House, O.

This place was visited Sept. 8, 1885. The general storm was central in southern Wisconsin, and the cloud-movements were as follows: from south-west at Dubuque, Davenport, Keokuk, Springfield (Ill.), Chicago, Indianapolis, Louisville, Nashville, Cincinnati, Columbus, and Sandusky; from south at Cairo, Toledo, Pittsburgh, and Erie; from south-east at Detroit, Cleveland, and Buffalo. In all this region there was not a single cloud-movement from the north-west or even west. On April 14, 1886, St. Cloud and Sauk Rapids, Minn., were injured by a tornado. The general storm was central in north west Dakota, and the cloud-movements were as follows: from south-west at North Platte, Des Moines, and Valentine; from south at Deadwood, Omaha, Leavenworth, Springfield (Mo.), Springfield (Ill.), Cairo, St. Louis, Dubuque, and La Crosse; from south-east at Bismarck, Moorhead, St. Vincent, and St. Paul. Here not only are there no west or north-west cloud-movements, but also in the immediate tornado region the movement is markedly from the south-east.

Mount Vernon, Ill.

This tornado occurred Feb. 19, 1888. The general storm was central in eastern Iowa, and clouds were moving as follows: from south-west at Keokuk, Memphis, and Louisville; from south at Springfield (Ill.), Chicago, Indianapolis, Toledo, St. Louis, Cairo, and Chattanooga; from south east at Milwaukee and Davenport.

This is an exceedingly important fact, as will be seen later on, and seems to be abundantly established.

Distribution of Tornadoes.

Rarely do these violent outbursts occur singly. In any region favorable for tornado development, two hundred to

four hundred miles to the south-east of the centre of the general storm, we shall find, after the hottest part of the day, a line of tornadoes occurring one after the other, and moving almost invariably to the north-east. An hour or so later, another line will be found parallel to the first, and about fifty miles south-east of the first. In some cases, as in the great Louisville tornado, there may be six or even more of these lines. They are entirely independent of each other, and very clear cut, there being no destruction between. The last line may not begin until 8.30 P.M., more than five hours after the hottest part of the day.

Velocity.

A marked feature of these outbursts is their most rapid translation across the earth for two hundred and sometimes three hundred miles. The speed is rarely under forty miles per hour, and there have been well-authenticated cases where it has reached over eighty miles per hour, notably in the Louisville tornado. It should be noted that the general storm, while travelling in the same direction, attains a velocity only half as great; for example, at Louisville it was thirty-eight miles per hour, which is very much above the average.

Thunder-Storms.

All through this region thunder-storms are very numerous, and are an invariable accompaniment. Sometimes vivid displays of lightning occur in the tornado, and undoubtedly these would be observed much oftener were not the beholder awe struck by the terror-inspiring phenomenon. A careful study of thunder-storms, occurring at any time, has shown that they have a velocity double that of the fostering general storm, and are always found within the region six hundred miles to the south-east. It has come to be generally admitted that tornadoes and thunder-storms are analogous phenomena, and that the former are an intensification of the latter. If this be true, we see at once what an enormous advance has been made. We do not need to wait for the full-fledged monster, whose very appearance drives away all thought save flight for safety, but we may study it in its gentler moods.

Lurid Sky.

Let us take a slightly closer view. Almost the first warning after the appearance of dark and threatening clouds in the west, as in a thunder-storm, is a peculiar lurid or greenish tinge in the sky from the south to the west. This "tornado-sky" is a characteristic feature, and it is believed that to those who have studied the phenomenon this will always serve as a warning for the more serious results which soon follow.

Two Clouds.

Many observers have seen very black clouds,—one to the west or north-west, and the other to the south-west,—which seem to rapidly advance, and, when they meet, to form the tornado. This is believed to be in the nature of a perspective effect, and the clouds to be an immediate accompaniment of the tornado. A full explanation of this phenomenon will be given later.

Cloud of Dust.

It is a very significant fact that in very many cases the funnel-cloud, which has a sharp outline and should be the

first thing seen at a long distance, is not seen till it is just upon the observer. This is due to an enormous cloud of dust directly in front of the tornado, rising oftentimes to a great height. Such a cloud of dust has often been seen in thunder-storms in regions never visited by the tornado. It is produced by a tremendous outrush of air from the tornado, and indicates almost conclusively that there is a plenum, and not a vacuum, at the centre. That this outrush of air could be produced by the fall of raindrops carrying air with them, has been proved impossible. The calculation showed that the heaviest rainfall that ever occurred could not produce a velocity greater than one-tenth of a mile per hour, which is practically inappreciable (see *American Meteorological Journal*, September, 1887, pp. 206-211).

Loud Roar.

As the tornado approaches, an indescribable roar is heard. It has been likened to the bellowing of a million mad bulls, the roar of ten thousand trains of cars, etc. This is certainly a most significant fact, and one that has not been sufficiently dwelt upon. The roar was analyzed by one observer, and was found to be precisely similar to a continuous roar or rumble of thunder. There is no question but that it is a marked electrical phenomenon, though just the manner of its production demands most careful investigation. Another explanation will be given under another heading.

The Tornado.

These warning sights and sounds are quickly followed by the funnel-cloud itself, like a great balloon sweeping its neck round and round with terrible fury, and destroying every thing in its path. It has been likened to an enormous elephant's trunk. It whirls with almost incredible velocity in its mad career, with a motion back and forth, sometimes leaving the earth a moment, then bounding back to continue its dire havoc. The whole destruction occupies but three or four minutes; but in that time the stanchest houses of brick or stone have been demolished, and sorrow and ruin have been spread all along its path.

Clearing Sky.

The exceedingly circumscribed nature of the tornado is shown by the blue sky or stars appearing a few minutes after it has passed. The wind turns to the south again, every thing quiets down, and no one would think that a terrible catastrophe had occurred, except for the devastation that is all about, and the cries of the unfortunates.

Width of Path.

The width of the destructive path has been given as high as a mile, but this is undoubtedly due to an erroneous estimation of the real track. There are always south-westerly indraughts which produce more or less destruction on the south side, but these should be carefully distinguished from the track proper or the region of greatest destruction. This may reach a thousand feet, though its width is rarely over two hundred or three hundred feet.

Distribution of Débris.

In the central line of the tornado all timbers and trees are strewn in the same direction, as though a mighty river had passed and left them behind. Where trees are not completely uprooted on either side of the path, they all lie with

their tops inclined to the central line; that is, on the south side they are toppled toward the north-east, while on the north side toward the south-east. This appearance or action may be due to the indraughts, and should be carefully distinguished from the effect of the tornado proper. The same remark may be made as to the distribution of fences and light objects on either side of the path.

Velocity of the Destructive Wind.

This should not be confused with the onward motion of the tornado, which is comparatively slow. The whirling of the cloud is the cause of the great destruction. This has been estimated as high as a thousand miles per hour; but such a velocity as that is highly problematical, and is due to erroneous assumptions. Probably the most accurate measurement of this velocity ever made was at Wallingford, Conn., on Aug. 9, 1878. Here the tornado blew off monuments in a cemetery without chipping either the upper or lower stone. In one case the stone was $2 \times 2 \times 4$ feet in dimensions, and would have required a velocity of about two hundred and sixty miles per hour to blow it off.

Direction of Whirl.

This has been reported again and again as from right to left, "counter-clockwise;" and this has caused a notable modification of the old theory that the whirl in a tornado may be either way. It is probable that this unanimity of opinion is due to other causes than careful observations. The determination of the direction of a whirl is practically impossible, unless the observer is within a very short distance, as any one may see for himself in the whirls of a dusty street. The only possible way to determine the direction of the whirl is to be near enough to see the actual motion of the leaves and twigs upon the ground. If one looks at the whirling column, he can learn nothing positive. This question is by no means settled yet, and there are reasons for thinking the old theory correct.

Air-Pressure.

Until very recently it has been assumed that there is a partial vacuum at the tornado centre. It is admitted that in a thunder-storm the pressure rather suddenly rises, nearly a tenth of an inch oftentimes; and, if the tornado is analogous, we may reason that the pressure rises in that. Professor Davis, in the *American Meteorological Journal* (February, 1890, p. 452), says that this fails to take account of the causes of increased pressure in thunder-storms, and of the decreased pressure in tornadoes. This seems a remarkable argument. Where does the severest thunder-storm and greatest increase of pressure leave off, and the tornado, with an absolutely reversed pressure, begin? The strongest argument that has ever been advanced has been the seeming bursting or exploding of houses in a tornado. This could have been occasioned by a sudden blow on any side of the house, whereby the pressure inside would be increased, and the walls thrown outward. This view was advanced some years ago, and has received a recent most remarkable confirmation in the report of a destructive storm at St. Louis, Jan. 12, 1890. The observer, a very intelligent man, writes, "In all cases of falling walls, it was noted that they fell outwards. In all cases of houses which at first sight appeared to have exploded, it was ascertained that immediately

before or at the time the walls gave way, the wind forced in some portion of the south wall, as a window or door, thus probably accounting for the outward pressure on other walls." The most important observation in connection with these exploded houses, however, was the record of a barograph, which just at this moment showed a remarkable rise in pressure. In the Louisville tornado, also, a barograph within a mile or two of the track showed first a slight sudden fall and recovery, due probably to the wind, and afterward the tornado-rise, as at St. Louis. This evidence is cumulative; and when we consider that the wind blows away from the tornado in front, and that of two similar objects standing side by side, one very heavy and the other light, the former is swept away while the other remains untouched, the evidence seems almost conclusive that there is no diminution of pressure in a tornado. It is probable that there is no fact in the whole observation or make-up of a tornado of such extreme importance as this, and it will be touched upon again in an explanation of a seeming rush of objects into the funnel. It will undoubtedly be thought, that, after all that has preceded, we really know very little of the mechanism of a tornado. This is true; but, if we have advanced far enough to be able to say what it is not, we may congratulate ourselves, and feel that our labor has not been entirely in vain.

H. A. HAZEN.

THE MANUFACTURE OF OZONE.

A COMPANY has been formed in Berlin for supplying the necessary plant for the conversion of oxygen into ozone on a larger scale than has hitherto been attempted, and the idea is gaining favor in many quarters that ozone can be economically employed for many sanitary purposes, says London *Industries*. Steps are being taken for extending the operations of the company to New York and London, as they have secured the patent rights for certain improvements in the electrical production of ozone from atmospheric oxygen in most countries. The Berlin doctors have repeatedly employed ozone, with very satisfactory results, in individual cases, and recently the company above alluded to have placed on the market a so-called ozonized water, which is stated to be a solution of ozone in that liquid. It is, however, well known that ozone is not very soluble in water, and that it readily undergoes decomposition, forming hydrogen peroxide and oxygen. The commercial name for this new antiseptic is "antibacterikon," and it possesses remarkable oxidizing properties. When added to water containing any appreciable quantity of living organic matter in the dark, it at once causes a phosphorescent appearance, and the organisms are completely destroyed in a short time. Such ozonized water is stated to have a faint metallic taste, and is used for producing sterilized water, or sterilized fluids, for bacteriological research. At present the ozone is manufactured from oxygen obtained by heating pyrolusite in the old way; but of course, with a greater demand, the Brin's oxygen process could be employed. The conversion takes place in a Siemens tube, or series of Siemens tubes, which do not differ essentially from the original form of ozonizer. The electric discharge is made by a Ruhmkorf coil in the usual way, or an accumulator is employed and a mercury contact breaker. It is proposed that ozone should be produced in this manner in large manufactories, and thus contribute to their sanitary improvement. Dr. Förster of Berlin has recently urged the importance of endeavoring to supply a small quantity of ozone to the air of towns and other thickly populated districts, and the company believe that their system can be worked economically and at the same time produce very satisfactory results from a hygienic point of view. It has been pointed out that many epidemics, e.g., influenza, appear to take place at those seasons of the year when the atmospheric ozone is at a minimum, and it is thus argued that

an artificial supply of this gaseous oxidizing agent would possibly prevent, and at any rate considerably modify, such outbreaks of disease.

THE OIL-FIELDS IN NEW ZEALAND.

The New Zealand Government attach a great deal of importance to the indications of extensive oil fields in Taranaki. The report of the inspecting engineer of the mines department, who has made a special examination of the territory at the instance of the government, says the *Australasian Journal of Commerce*, is strongly confirmatory of the presence of mineral oil. In the neighborhood of New Plymouth there are many surface indications, particularly along the shore, gathered under bowlders and floating on the water. Farther inland the water gathering in the wells which are sunk is found to have a strong taste and smell of petroleum, so as to be quite unfit for drinking. If all these indications should turn out to be well founded, and oil be discovered in paying quantities, the find will be of great value to New Zealand in many ways, the most important of which, perhaps, is as a fuel for smelting purposes. Vast quantities of iron sand — according to the "New Zealand Year Book," a sand formed by the grinding-up of iron ore by the action of the waves — lie for hundreds of miles along the coast of the North Island; and this pulverized ore is practically worthless at present from lack of a sufficiently cheap fuel to smelt it. Should oil be obtained in such close proximity to these supplies of ground iron ore, a new and important industry may be developed into large proportions. Such, at least, is the hope of those who are investigating the matter on the spot. Independent of this, however, a new and extensive oil-field in the South Pacific would speedily become the source of supply for the whole of Australasia and the entire East. New Zealand would become an active competitor with the Baku wells, even if the Russian supply should falsify present indications of failure, and continue. The proximity of the supposed New Zealand field to the coast and port of New Plymouth would give it an advantage over both Russian and American oils in lessening the cost of both crude and refined on shipboard.

THE USE OF OIL.

ATTENTION is called by the United States Hydrographic Office to the fact that the Chamber of Commerce of Bordeaux, France, has offered a series of prizes in order to induce masters and officers of vessels to make thorough trial of the use of oil at sea, especially as regards the best way to use it and the practical benefits to be derived from such use. There are three sets of prizes, each set consisting of a first prize of 200 francs (\$40) and a second prize of 100 francs (\$20), to be awarded for the best reports received by Jan. 31, 1891, based upon actual experience. Programmes for the three competitions are as follows:—

1. STEAMERS.—Trials of the use of oil must be made under various conditions, particularly the following: heavy head sea, heavy quartering sea, towing in bad weather, engine or rudder disabled.

2. SAILING-VESSELS.—Trials to be made under various conditions, but especially when crowding sail with a strong wind abeam.

There must also be considered, in connection with the first and second competitions, the use of oil in lowering and hoisting boats, taking a pilot aboard, saving life at sea, riding out a gale in an unprotected anchorage, loading and unloading in a seaway, wearing and tacking ship.

3. FISHING-VESSELS, PILOT-BOATS, YACHTS, LIFEBOATS, etc.—Experiments in using oil when crossing bars, landing in a surf, etc.

GENERAL RULES FOR THE COMPETITIONS.—Each experiment must be described fully as soon as possible, and an account inserted, under the proper date, in the vessel's log book. In the case of fishing-vessels and pilot-boats, however, this may be dispensed with; but upon return to port a full statement must be made to the maritime authorities. Full details must be given regarding the direction and force of the wind, the state of the sea,

and the condition and speed of the vessel. There must be stated, also, the position and character of the apparatus for the use of oil, the amount of oil used per hour, and the kind of oil used, according to the temperature of the water.

As stated above, each of these three competitions closes Jan. 31, 1891, by which time all reports must have been handed in to the Chamber of Commerce, Bordeaux, France. The published programme makes no specifications as to the nationality of the competitors or the language to be used, and the competition is therefore understood to be open to any one, subject only to the rules stated above, which should be carefully adhered to. The Hydrographic Office will gladly receive and forward any reports offered in competition, whether sent to Washington or handed in at any branch hydrographic office.

It will be noticed that it is the desire of the Bordeaux Chamber of Commerce to encourage the use of oil by masters of vessels, and the prizes are offered with this end in view. Reports are wanted regarding actual trials undertaken and reported as described above.

NOTES AND NEWS.

A PIECE of crown glass forty inches in diameter and two inches and a half thick has been shipped from Paris to Clark Brothers of Cambridge, Mass. It is intended for a forty-inch object-glass of a telescope for the University of Southern California, exceeding in size the Lick telescope. About two years' careful labor will be required to convert the rough glass into a finished lens.

— At a recent meeting of the American Meteorological Society in Washington, resolutions were adopted favoring the recognition of the eminent services of American electricians by perpetuating their names in the nomenclature of electrical units. In the names of units thus far adopted the names of Americans, such as Franklin and Joseph Henry, have not been recognized. It is proposed, as a beginning, that at the electrical conference to be held in this country in 1892 the name of Henry, or some modification of it, be given to the unit of self induction, he having been the first to investigate that phenomenon, and his investigations having been more complete than those of other electricians before or since.

— A special aim of those connected with the Wharton School of Finance and Economy at the University of Pennsylvania has been for some time past the securing of a complete series of the laws of all countries. Such an undertaking it requires scores of years to complete. In this department, however, the Wharton School library has already made a good beginning. There has been presented to it a set of the Prussian Statutes at large, including the years 1806 to 1886. There are to be found all the laws of the new German Empire, from its creation in 1866 down to 1886; a collection of works on German constitutional and administrative laws; and a work upon the public administration of Austria, by Ulbrich.

— Professor Edmund J. James, of the University of Pennsylvania, will present a paper before the American Academy of Political and Social Science on a new system of passenger fares. He will show that the railways of the United States, by their failure to adopt a reasonable and simple system of tariffs for passenger traffic, have prevented that development of this branch of their business which could have been expected, considering the natural tendency of Americans to travel. England has, relative to her population, nearly four times as many passengers on the railroads as the United States, though the character of the American people gives good reason to suppose that we should naturally have twice as many as England.

— The committee having in charge the interests, in this country, of the forthcoming Jamaica International Exhibition are working vigorously to insure a good representation of our manufactures and products. They have secured specially low freight rates for exhibits, and have made arrangements whereby exhibition goods will be returned free of freight from Jamaica, by the line on which they were shipped, on production of the outward bill of lading. Space will be reserved for empty cases, and all exhibits

will be conveyed from the wharf to the building free of charge. Exhibitors of apparatus requiring the use of water, gas, or steam, should state, on applying for admission, the quantity considered necessary. Those who wish to show machinery in motion must state the rate of speed at which the machine is to be driven. Motive power to the extent of 100 horse-power will be provided by the commissioners free of charge, but all counter-shafting, pulleys, and connections with main steam-pipe, must be provided by the exhibitors. The motive power will be under the direct control of the commissioners. Applications for space can be sent to the committee up to June 12, or to Kingston up to July 1, and goods will be received in this city from Aug. 20 to Nov. 15, 1890. The despatch, transmission, unpacking, removal of empty cases, fitting up and erection of exhibits, must be done by private agents. A list of those prepared to act as such, both here and through their representatives in Kingston, will be furnished upon application to the committee.

— The latest of the Johns Hopkins University Studies in Historical and Political Science is a pamphlet on "Spanish Colonization in the South-west," by Frank W. Blackmar. The subject of which it treats is much less familiar to the mass of historical readers than the English and French colonization of the Atlantic coast and the Mississippi valley, and yet in its bearings on the history and the legal systems of California and New Mexico it is of great importance. Hence Mr. Blackmar's monograph will be of use. He begins with a general account of Spanish policy, with a somewhat lengthy comparison between Spanish and Roman colonies, which has little bearing on the subject in hand; but after this introductory matter he gives a careful and interesting description of the different kinds of colonies established by the Spaniards in the South-west, with some account of the minute laws and regulations framed by the home authorities for their government. The most interesting chapter is that on the mission system, which tells the story of the settlements of converted Indians under the control of the priests, which formed so marked and unique a feature of Spanish control in the South-west. Altogether this is one of the best monographs of the series to which it belongs.

— We have received several numbers of "The Humboldt Library," a series of pamphlets issued by the Humboldt Publishing Company of this city. They are reprints of foreign works in clear type and on good paper, and are sold at the low price of fifteen cents each; double numbers, thirty cents. Some of those now before us, as, for instance, Mill's "Utilitarianism," are so old and familiar as to call for no remark; while others are of more recent composition. Mr. S. Laing's "Modern Science and Modern Thought," which is probably familiar to many of our readers, is an attempt to see how much of Christianity can be reconciled with physical science and historical criticism. It is written in a thoughtful and reverent spirit, but does not contain much but what is now the common property of minds that have been trained in scientific thought. Another of the pamphlets contains Mr. David G. Ritchie's essay on "Darwinism and Politics" and Professor Huxley's well-known paper on "Administrative Nihilism." Mr. Ritchie's work is chiefly a criticism of the doctrine of the "struggle for existence" as applied to social life. He, of course, admits the fact of such a struggle, but insists, in opposition to Spencer and his followers, that it is our duty to regulate it in accordance with reason and right, and that it is wrong to let the struggle proceed in human life and society in the same unmoral way as it does among the brutes. So far we agree with Mr. Ritchie, but we are sorry to have to add that his remedy for the ills of life is socialism. Professor Huxley's paper, as is well known, is an able argument for extended activity on the part of the State, but without any tendency of a socialistic character. Professor A. Schäffle's "Quintessence of Socialism," translated from the German, is a careful, and we think very correct, statement of the practical aims of the State socialists. It is written by an opponent of the system, but is eminently fair as well as thoroughly studied and carefully expressed, while the author's criticisms are pointed and sometimes profound. The work is well worth reading by all who are interested in the subject.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada..... \$8.50 a year.

Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XV.

NEW YORK, MAY 2, 1890.

No. 378.

CONTENTS:

A SUPERIOR ARC-LAMP.....	267	LETTERS TO THE EDITOR.
ON THE USE OF THE PHONOGRAPH		Recognition by Young Children.
IN THE STUDY OF THE LAN-		J. Mark Baldwin 274
GUAGES OF AMERICAN INDIANS		Whirlwinds. M. A. Veeder.....
J. Walter Fewkes 267		275
FACTS ABOUT TORNADOES		Effigy-Mound in the Valley of the
H. A. Hazen 269		Big Sioux River, Iowa.
THE MANUFACTURE OF OZONE.....	272	T. H. Lewis 275
THE OIL-FIELDS IN NEW ZEALAND	272	Gorse or Furze. J. R. McGinnis 275
THE USE OF OIL.....	272	Lightning-Discharge.
NOTES AND NEWS.....	273	S. T. Moreland 276
EDITORIAL.....	274	Sunspots and Tornadoes.
Professor F. H. Snow, the New		James P. Hall 276
Chancellor of the University of		BOOK-REVIEWS.
Kansas.		Graphics, or the Art of Calcula-
		tion by Drawing Lines.....
		277
		AMONG THE PUBLISHERS.....
		277

FOR SOME TIME PAST there has been a tendency in our colleges and universities to select as their presidents men who have attained eminence in special lines of research. This is notably true in regard to the case of Presidents Jordan of Indiana, Schaffer of Iowa, and Adams of Cornell. Another name may now be added to the list. We refer to the recent selection by the regents of the University of Kansas of Professor F. H. Snow, Ph.D., as chancellor of that institution. Professor Snow was graduated at Williams College in 1862, and afterwards prepared to enter the Congregational ministry. He, however, soon showed a special interest in natural history, and was elected a member of the first faculty of the University of Kansas when it was organized, in 1866. For several years he taught a variety of branches, but as the institution grew in strength he was enabled to confine himself to a greater extent to the specialties in which he had the most interest. He has been an indefatigable collector throughout the Western States and Territories, paying special attention to entomology. In honor of his distinguished services to the State, the new natural-history building recently erected by the State was named "Snow Hall." He has not only carried on the work of instruction in his large classes at the university, but has found time to make careful investigation in various fields of biology, and to furnish much valuable material to current scientific literature. Though a specialist, he is not a narrow man, but is well informed

on the topics of the day, especially those that attract the attention of the educational world. In all positions where executive ability is required, he has shown himself eminently fitted for the task. This appointment meets the hearty approval of the faculty of the university, and of the people of the State.

LETTERS TO THE EDITOR.

. Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Recognition by Young Children.

ONE of the most obscure topics, as well as one of the most neglected, of modern psychology is that of recognition. The question, "Why is it that I recognize an image when it returns to my consciousness?" is usually passed over unobserved or intentionally omitted in our general treatises. Experiments, however, upon the question are forcing it upon our notice, thus doing a service which we are coming to expect from the new method wherever it is applied.

I have recently advanced a theory of recognition,¹ based both upon mental analysis and objective experiment,² according to which the feeling of familiarity called recognition arises from the re-instatement of the apperceptive or relational process of the earlier presentation. According to this theory, single unrelated homogeneous images (bell-stroke, pure color) would not be recognized, single complex images (human face) would be recognized only in the degree in which the complexity had impressed itself in the first perception, and clear recognition would arise only when the relations attentively discerned were clearly brought out in the reproduced state. A further result would be that images, when reproduced, would largely depend upon and re-enforce each other in producing the feeling of familiarity.

I have recently had an opportunity to test a little child six months and a half old, with these points in view, and the result was quite instructive. Her nurse, who had been with her continuously for five months, was absent for a period of three weeks, and on her return was instructed first to appear to the child simply in her usual dress, but to remain silent; then to withdraw from sight, but to speak as she had been accustomed to; and finally to appear and sing a nursery rhyme, which by special care the little girl had not been allowed to hear during the nurse's absence. The first result was that the child gazed in a questioning way upon the face, but showed no positive sign of recognition; yet the absence of positive fear and antipathy shown at first toward the substitute nurse indicated that the visual image was not entirely strange. Second, the tones of the nurse's voice were not at all recognized, as far as passive indications even of familiarity were concerned,—a result we would expect from the greater purity and simplicity of the auditory images. The third experiment was attended by complete and demonstrative recognition. The visual (face) and auditory (rhyme) images must have re-enforced one another, giving again the old established complex apperception of the nurse.

As to the ultimate meaning of recognition, we are quite in the dark: it is only its mental conditions that fall to the psychologist. On the view given above, it would seem to rest in the active side of our mental life, and to consist in the diminished expenditure (whatever that is) involved in the repetition of an act of attention.

This case also shows, as far as any individual case can, that images from different senses vary greatly in intensity in early child-life, that they are not well differentiated from one another, and that even at the very early age of six months special memories are becoming more or less permanent.

J. MARK BALDWIN.

University of Toronto, April 23.

¹ Handbook of Psychology: Senses and Intellect (New York, Holt), pp. 176-178.

² Work of Lehmann, Philos. Studien, VI.

Whirlwinds.

It was my fortune a few days since to see a small whirlwind at the distance of but a few rods. The wind at the time was from the west, and was cold, and somewhat gusty and variable. The whirl persisted for several minutes, dying down and increasing again. Its direction of rotation was from right to left. As it passed across a road, the dust was lifted to a height of about thirty feet, forming a pillar, which disappeared when the grass at the roadside was reached. The query that arose in my mind was as to the nature of the currents which produced this upward movement of the dust. Such movement has commonly been ascribed to the suction effect of an indraught towards the whirl which has been supposed to exist. But as the breeze continued to rise, I could not help but notice that dust was lifted equally high by the chilly wind at points where there was no evidence whatever of a whirl. Such lifting by a cold wind blowing straight along certainly could not have been due to an upward current produced by an indraught. Indeed, this lifting resembles precisely the movements of sand at the bottom of a stream beneath eddies formed by the varying force of the current, a phenomenon readily observed in clear water.

M. A. VEEDER.

Lyons, N.Y., April 23.

Effigy Mound in the Valley of the Big Sioux River, Iowa.

WHILE at Sioux Falls, S. Dak., in the latter part of last July, I took the opportunity to look up and survey a group of mounds and a fort that are located about sixteen miles south-east of that city, in the valley of the Big Sioux River. In 1885, I was informed by an engineer, that, in running a preliminary line for a railroad a few years previous, he had passed through a group of mounds in that locality, and that there was a large fort just south of them.

The group in question is in the western part of Lyon County, Io., a mile and a half west of Granite Station, on the Sioux Falls branch of the Burlington, Cedar Rapids, and Northern Railroad. The country bordering the river here is more or less rolling and broken, especially on the western side. On the east side, at the Burlington crossing, there is a plateau which is from twenty-five to fifty feet in height above the river, and slopes to the southward. Bloody Run flows around the north end, and empties into the river near by.

On this plateau, to the north of the railroad, there are a hundred and five mounds, ranging from a foot to five feet and a half in height. Nearly all of them are common round burial-mounds; but among them are a few that are elliptical in shape, and there is also one animal effigy. The latter is 55½ feet in greatest length, and the body is 2½ feet in height. While apparently rude in design, the outline on the ground is regular, and the surface of the mound is smooth and symmetrical. There are many imitative mounds in the effigy region of Wisconsin that are no better in outline than this one. The peculiarity of this effigy consists in its isolated position, there being no others known to exist in the intermediate space between it and those to the eastward in the Mississippi valley, a distance of fully 270 miles. It is also the first mound of this class discovered within the limits of the Missouri River basin; and its position, therefore, is analogous to those of Ohio and Kentucky, yet the isolation is not so great.

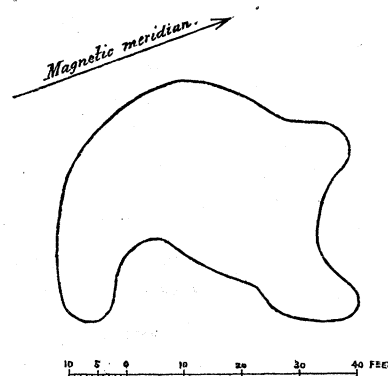
There is no system in the arrangement of the mounds, they being located in a haphazard way, here and there, as fancy dictated. Scattered among them, principally near the centre of the group, are a large number of that kind of stone monuments which, in a published article on the subject, I have called "boulder outlines." Some of these extend up on the sides of the mounds, and in one case one of the larger mounds is surrounded by a circle of boulders. These instances denote a later occupancy, or at least that they were placed there after the mounds were constructed.

Just south of this group, on the south side of the railroad-track which separates them, there is a large fort or enclosure, of an irregular elliptical shape, which is the largest one known to exist north-west of Ohio, except "Aztalan," Wisconsin. Its inside

area is about fifteen acres, and the walls at the present time are from one to two feet in height, with an average width of eighteen feet. They were probably palisaded when in use. This fort was also built after the mounds were constructed, for at one point the wall intersects a mound which is three feet and a half in height. That the mound was built first, is evident from the fact that the wall was raised in height at the junction, in order to surmount and pass over it without abruptness. Within and around the fort there are seven mounds, and between the fort and the railroad there were several others which have been destroyed by cultivation.

There is plenty of evidence to show that the plateau was occupied as a place of residence at some period in the past. Burned stone and chert flakes are especially numerous, while occasionally stone axes, celts, grooved hammers, arrow-heads, and ornaments of stone and copper, are found. Fragments of steatite vessels and pottery composed of shell and clay, and pulverized stone and clay, are also quite plentiful. Occasionally ornaments, beads, and tubes made of sea-shells have been found in some of the mounds in this and other groups in the vicinity.

This locality was visited in November, 1886, by Professor Frederick Starr of Cedar Rapids, Io., on which occasion he excavated four mounds, two of which were situated on the south side of the railroad track. He described their contents in the *American Antiquarian* for November, 1887 (vol. ix.). In his article he mentioned the existence of the "stone circles," but no reference was



made to the fort or the effigy. The mounds in which his excavations were made were within three hundred feet of the north-east wall of the enclosure, which was certainly in plain view; and it is strange that it should have been overlooked by him.

It is evident that this point was at one time a site of the mound-builders, and that later they were compelled to fortify themselves against some hostile neighbor. The large amount of village debris scattered over the plateau, the great number of burial-mounds in that vicinity, together with the size of the fort, indicate also that the inhabitants were quite numerous.

T. H. LEWIS.

St. Paul, Minn., April 23.

Gorse or Furze.

THE following is a copy of an extract from a letter from the United States commissioner of agriculture, dated March 28, 1890, acknowledging the receipt of a specimen of gorse or furze discovered by me growing near Hampton, Va., and stating, that, as far as that department is aware, this is the first instance known of its presence in this country: "Your note of the 26th inst., and the small box of specimens of the European furze (*Ulex Europæus*), received. This plant was probably introduced into the grounds of the Fort [Fort Monroe, Va.] many years ago, and does not seem likely to spread so as to become particularly obnoxious to agriculture. I am not aware that it has been observed in any other part of this country in a wild state."

I should be glad to know whether it has ever been seen in the United States before.

J. R. MCGINNIS.

Fort Monroe, Va., April 23.

Lightning-Discharge.

ON Feb. 24, 1890, at 8.45 P.M., there was a case of lightning-discharge here which is perhaps worthy of notice. The building struck was Newcomb Hall, the property of Washington and Lee University. It is a three-story brick building covered with tin, having seven downfalls not connected with the earth, and having no lightning-rods. On top of the building, for lighting and ventilating purposes, is a square cupola. This has wooden corner-posts six or eight inches square; its walls are almost entirely glass; its roof is tin. The distance between the tin on the roof of the cupola and the nearest tin in connection with that on the roof of the building is about four feet. The lightning struck the roof of the cupola, passed down one of the corner-posts to the roof of the main building, and then down five of the seven downfalls to the ground. The roof of the cupola is "hipped;" and just under each of the four eaves, in a horizontal position, are two planks, each about ten inches wide. The four planks adjacent to the post struck were thrown entirely off. The tin on the roof just above the post was thrown back, uncovering about a square yard of the roof. The post itself was torn to splinters at the top. All but five panes of glass, out of a total of about fifty in the walls of the cupola, were shattered. Nearly all of the glass fell outside, and the tin all over the roof of the cupola showed signs of having been pushed upwards. When the discharge left the post, it divided, part of it going to the tin on the lower part of the post and thence to the roof, and part of it to a strip of tin on the window-sill. This strip of tin was composed of five or six pieces tacked together, not soldered. Nearly all of these joints were separated, about two inches of the tin being bent over in the direction in which the discharge travelled, from above down. This part of the discharge reached the tin on an adjacent post of the cupola, and thence passed down to the roof. One sharp corner of tin was burnt off, leaving a burnt curved edge about an inch in length. The two posts and the tin on them were blackened at the point where the discharge reached the tin. There was no further trace of the discharge until it reached the ground. As already stated, it passed down five of the downfalls, but apparently much the largest part passed down one. At this point, for a distance of ten or twelve feet, the ground was as much turned up as it would have been by a large plough. Some of the earth was thrown to a distance of twenty or thirty yards. The clerk of the faculty has his office in a corner room on the ground floor next to this downfall. He found the steel pens in a box on his desk so strongly magnetized that one pen could support four or five others. The pens in the penholders were also magnetized. Two panes of glass were broken in this room. Fifteen or twenty feet from this corner of the building is a water-pipe, wrought iron, one inch in diameter. This pipe at a short distance connects with a cast-iron pipe whose internal diameter is two inches; this, in turn, connects with the system of pipes supplying the town of Lexington with water. The two-inch cast-iron pipe was found the next day to be leaking badly in seven places within a few hundred yards of Newcomb Hall. There seems to be no reason to doubt that the discharge in some way burst the pipe. The leak nearest the building was over fifty yards away. There were no indications of melting. One hole in the pipe was an inch wide and about three inches long, a piece of that size apparently having been knocked out. The pipe is very old and rotten, being almost as soft as graphite. The water in the pipe is under a pressure of about a hundred feet of water. The only other case with which I am acquainted, where water-pipes were damaged by lightning, is that given by Secchi in the *Telegraphic Journal and Electrical Review* (London, 1872, translated from *Les Mondes*). In that case the pipe was broken, and some lead melted, at the point where the discharge first reached the pipe.

The report at the time of the discharge may be described as terrific; it was the more so, because it was the very first indication of any thing like a thunder-storm. There was no lightning before this discharge, and not much after it.

Besides the facts given above, there were some other reports concerning the discharge which may be of interest. Having heard that some persons saw what seemed to be a ball of light-

ning, I made as careful inquiry as I could concerning it, with the following result:—

1. A student was sitting before an unshaded window, from the roof of which Newcomb Hall is visible, and less than two hundred yards from it. Attracted by a bright flash, he looked up, and reports that he saw a ball of fire, in size and appearance about like a Roman candle, slowly descending on the building. It disappeared about the time it reached the roof, when the explosion was heard. He at once reported what he saw to his uncle, the president of the university, saying he thought the building was struck. They then looked out for signs of fire, but saw nothing.

2. In another direction, and at a greater distance, is a house from which Newcomb Hall is plainly visible from top to bottom. A lady in this house, sitting before a window, had her attention attracted by a flash, looked up, and saw a shower of fire-balls falling on Newcomb Hall. On careful inquiry, I learned that she did not see these balls above the top of the building: they seemed to be very nearly or quite on it when she saw them. She possibly saw what was concealed by the building from the student. This lady told me that some young ladies in another room in her house saw what she herself saw: I did not talk with them about it.

3. About a quarter of a mile from Newcomb Hall, on Main Street, stands the Court-House, a short distance back from the street. Mr. B. was standing in the door of the Court-House, looking out on Main Street in the direction of Newcomb Hall. He first heard a sharp, quick noise like that produced by slapping the hands together, which seemed to come from his telephone. He then saw across the street from him, at a height of about fifteen feet from the ground, a ball about the size of a large orange just luminous enough to be plainly visible, followed by a brighter trail ten feet long. This ball moved horizontally and slowly up the street about twenty yards, and then burst with the brightest flash Mr. B. ever saw, and a terrible noise. This noise was immediately followed by another of like character in the direction of the university buildings. Mr. B., I should state, is a man of the very highest character, and his word would be taken without question by all who know him. He is calm and unimaginative. I omitted to mention that his face felt as if it had been hit with sand, and that there was an unpleasant sensation for some hours afterwards. It was rainy, and Mr. B. saw no one on the street; but I learned that three negroes were standing on the sidewalk nearly under the point where Mr. B. saw the globe burst. As they were not moving, Mr. B. might easily miss seeing them. I questioned two of these negroes. They were standing facing each other, one looking up the street, and the other down. Each of them thought he saw a ball of fire fall in the street in the direction in which he was looking, and at a distance of from fifty to one hundred yards away. Neither of them knew any thing of the explosion reported by Mr. B., although it was almost immediately over their heads, and only twenty or thirty feet away. Newcomb Hall could not be seen by either Mr. B. or the negroes.

I give the facts as I gathered them, without comment. There is no reason to think that any of the persons questioned failed to give a substantially correct report of the impressions made on their senses.

S. T. MORELAND.

Washington and Lee University, Lexington, Va., April 26.

Sunspots and Tornadoes.

THE following figures show a slight parallel between the frequency of tornadoes in the United States for the last twelve years, and the sunspot curve of the eleven-year cycle. The solar data employed have been obtained from Professor Rudolph Wolf (Zurich), the well-known sunspot specialist. The tornado numbers are supplied by Lieut. John P. Finley of the United States Signal Service, but should be regarded as only approximate, and subject to more or less change, for these reasons: (1) better facilities now exist for obtaining news of tornadoes than existed fifteen or twenty years ago, owing to the special activity of the United States service, the organization of State weather bureaus, and the co-operation of the press; and (2) west of the Mississippi the coun-

try is more densely settled than it was one or two decades ago, and many local storms would now be observed where they could not have been seen and reported some years ago. Thus, the average number of tornadoes reported annually for the last ten years is 159, while for the previous ten years it was only 45. For this reason, it would not be safe to compare the spots with any former cycle. In order to make the figures for 1878-89 fairly comparable, those for the first three or four years may be raised slightly, perhaps; and those for the last two may be increased 2 or 3 per cent by belated returns. The annual average, then, would be more than 160 (say 170), with minima at the ends of the series, and a maximum near the centre:—

Year.	Spots.	Tornadoes.	Year.	Spots.	Tornadoes.
1878	3.4	77	1884	63.3	216
1879	6.0	88	1885	50.3	139
1880	31.6	141	1886	25.7	290
1881	54.1	113	1887	13.1	173
1882	59.3	90	1888	6.7	122
1883	62.8	167	1889	6.1	129

Another curious fact is that the greatest number of tornadoes reported upon one day, according to Finley, was 60, on Feb. 19, 1884. Wolf's relative number for January, 1884 (92.1), is the largest for any month during this whole cycle, except April, 1882 (97.0); but the average for the six or seven months beginning with October, 1883, is much greater than for any similar period in 1882. Tacchini (says *Nature*, July 1, 1886, p. 194) fixes the height of solar excitement in February, 1884; but Professor P. M. Garibaldi of Genoa quotes Tacchini as placing the maximum in May, 1884. The maximum of protuberances found by Tacchini (*Nature*) was in March, 1884, though Garibaldi says June–August, 1884. At the Royal Observatory, Greenwich, the rotation-period (27 days) containing the largest daily average spottedness in twelve years, began July 4, 1883, when it was 2,037 millionths of the sun's visible hemisphere; but the best two-period exhibit was from Dec. 14, 1883, to Feb. 7, 1884, when the daily mean was 1,817 millionths. The greatest facular displays recorded in the Greenwich "Results" were in the rotation-periods beginning Dec. 14, 1883 (3,151 millionths) and Feb. 7, 1884 (3,467 millionths). Garibaldi, at the Royal University, Genoa, recorded the greatest magnetic variation (in the needle's daily swing) in April–July, 1884, and from August, 1885, to April, 1886. At Toronto, the biggest magnetic storms of the maximum stage of this last sunspot cycle occurred in November, 1882, September, October, November, 1884, and March, 1886. During the first seven months of 1884, at Toronto, the magnetic perturbations were few and slight.

The general yearly parallel between spots and tornadoes is far from proving any relation between the phenomena; and the correspondence between the maxima of spots, protuberances, magnetic variations, magnetic storms, and tornadoes is not very close. Yet the comparison here made is not without interest.

JAMES P. HALL,

Brooklyn, N. Y., May 1.

BOOK-REVIEWS.

Graphics, or the Art of Calculation by Drawing Lines. By ROBERT H. SMITH. Part I. London and New York, Longmans, Greene, & Co. 8°.

THIS work treats of graphics as applied especially to mechanical engineering. The volume before us is but the first part of the complete treatise, and deals mainly with the analysis of stresses in engineering structures. It is accompanied by an atlas containing twenty-nine plates and ninety-five diagrams, the text and the diagrams being each essential to the better interpretation and ready comprehension of the other. The second part of the work, which it is hoped will soon be published, will deal mainly with synthetic problems, aiming more at the design than the analysis of structures and machines.

The department or branch of descriptive geometry dealt with in this work, the "art of calculation by drawing lines," has assumed considerable importance, so that Professor Smith's scientific treatise on the subject is as timely as it is practical and comprehensive. The graphic method of computation, of course, has limitations in many directions, being less useful in simple cases than arithmetical and algebraic methods; but the method once thoroughly mastered, and its scope and limitations clearly understood, it will enable those who have a knowledge of elementary mechanics to utilize that knowledge to better advantage and with a greater degree of thoroughness, and to apply it to many of the every-day problems of engineering science without the aid of the more complicated portions of algebraic and trigonometrical mathematics or of the differential and integral calculus. Wherever the method is applicable, its use will result in a saving of mental fatigue, as it possesses great simplicity in many of its applications, leaves but little opportunity for the accumulation of gross errors, and is in itself a test of its own accuracy.

The work opens with a glossary of special terms and symbols, some of which are new and possessed of advantages in the matter of conciseness and precision. The introductory chapter presents clearly and with evident impartiality the advantages as well as the disadvantages of the method, and gives a brief sketch of the theoretical development of the subject. This is followed by a chapter on the instruments needed in the accurate working-out of the method; after which follow in order chapters on graph-arithmetic, graph-algebra, graph-trigonometry and mensuration, combined multiplication and summation, moments of parallel vectors, vector and rotor addition, locor addition and moments of locors and of rotors, the kinematics of mechanisms, flat static structures without beam links, flat static structures containing beam links, and solid static structures. The diagrams in the accompanying atlas are neatly engraved, and clearly printed on heavy plate paper.

AMONG THE PUBLISHERS.

THE issue of *Harper's Weekly* for April 26 devotes considerable space to the Stanley-Emin relief expedition. The article, which is copiously illustrated, gives the whole history of the expedition.

—A cheap edition, limited to a hundred thousand copies, of "Tom Brown's School-Days," is announced by Macmillan & Co., uniform in style with their paper-covered editions of Charles Kingsley's novels, of which something over a million copies have been sold in the past six months.

—One of the literary sensations of the winter in Paris was Camille Flammarion's astronomical romance, "Uranie," of which the Cassell Publishing Company are the American publishers. Up to the present time, M. Flammarion has been known as an astronomer, but now he has become a popular romancer. Mrs. Mary J. Serrano, translator of "Marie Bashkirtseff: The Journal of a Young Artist," has put M. Flammarion's French into English.

—In *Garden and Forest* for last week, Mr. H. H. Hunnewell, whose gardens at Wellesley, Mass., have been famous for a generation throughout the country, writes of rhododendrons and their culture; Professor Greene continues his notes on the shrubs of California; and the concluding portion of the review of Dr. Mayr's great work on the forests of North America is given. "The Woods in Spring," "Wild Plants under Cultivation," and "Hardy Plants for Cut Flowers," are titles of other articles. A road in Sherwood Forest is the subject of one illustration, and there is also a picture of a giant *Cattleya*.

—Messrs. Ginn & Co. announce as in press "Political Science and Comparative Constitutional Law" (two volumes), by J. W. Burgess, professor of constitutional and international law and history in Columbia College. In these two volumes Professor Burgess sets forth the general principles of modern political science and constitutional law. The State, as sovereign organization of the Nation, is sharply distinguished from the government. Government, to the author, is but one of the means through which the State attains its ends. The other means is liberty. The first volume treats of the Nation and the State as concepts of

political science. The formation of the Constitution, also, is regarded and treated as a political, not a legal process. Under the head of "Constitutional Law," the author describes the organization of liberty and of government. The latter topic occupies the entire second volume. The typical constitutions selected for comparison are those of France, Germany, England, and the United States.

—Treason, treason! Let us shout it before it may be too late. Here is Agnes Repplier writing in the May *Atlantic*, "The woman who goes to a Browning society when she would prefer cards and conversation; who sits, perplexed and doubtful, through a performance of 'A Doll's House' when 'Little Lord Fauntleroy' represents her dramatic preference; who reads Matthew Arnold and Tourguéneff, and now and then Mr. Pater, when she really enjoys Owen Meredith and Bootles's 'Baby and the Dutchess,'—pays a heavy price for her enviable reputation." She also makes a plea for the people who resemble that "unfortunate young woman who for years concealed in her bosom the terrible fact that she did not think 'John Gilpin' funny." The article, which is entitled "Literary Shibboleths," claims to be a plea for an honest confession of our real tastes in literature, and a warning against being carried away by literary fashions. Yes, this is all very well, but it would decimate the ranks of the would be literati. Mr. Morton gives us his second paper on "Some Popular Objections to Civil Service Reform."

—The opening article in the *Quarterly Journal of Economics* for April is by Francis A. Walker, on "Protection and Protectionists." It cannot be called a very satisfactory work, for it merely skims the surface of the subject, leaving its deeper aspects untouched; and, moreover, it fails to make clear the author's own position. President Walker begins by calling attention to the fact, well known to those who have watched the changes of public opinion, that the protectionism of the present day is very different from that of our forefathers, inasmuch as protection is now advocated as a permanent policy, and not, as in earlier times, merely as a means of establishing industries that were afterwards to become self-sustaining. He also points out certain other differences of

opinion among protectionists, and then touches on a few of the arguments on both sides of the question, but without presenting any thing specially new or profound. The next article in the *Quarterly* is by Professor E. C. K. Gonner of Liverpool, on "Ricardo and his Critics," and is an able defence of the noted English economist against some of the aspersions that have been cast at him. In particular, the writer shows that the attacks on Ricardo by the late German economist, Adolf Held, were not only in great part baseless, but were animated by an unbecoming spirit. Professor Taussig has a paper on "The Silver Situation in the United States," which is appropriate to the time. It is not a discussion of bimetallism, but a history of the coinage and circulation of our present silver money, together with an account of the existing state of the silver currency in its relation to gold on the one hand, and to paper on the other. Now that the advocates of silver are calling for an increased coinage of the metal, the facts and suggestions in Professor Taussig's article will doubtless be useful.

—Berly's "Universal Electrical Directory" (London, William Dawson & Son), now in the ninth year of publication, grows in completeness and usefulness with each succeeding year. The issue for 1890, which has recently made its appearance on this side of the Atlantic, contains a complete record of all industries directly or indirectly connected with electricity and magnetism, and the names and addresses of manufacturers in America, Great Britain, the continent of Europe, India, and the British colonies, beside much other matter of interest to those connected with electrical industries.

—D. C. Heath & Co. will shortly issue a manual on the "Reproduction of Geographical Forms," by Jacques W. Redway, author of "The Teacher's Manual of Geography." It is designed for teachers and students who wish to learn the details of sand and clay modelling as applied to geographical forms, and the projection, drawing, and interpretation of maps. The manual will be illustrated with the various projections used in map-drawing, including a number of very easily constructed ones that may be used by younger pupils.

Publications received at Editor's Office,
April 21-26.

- ALLEN, H. A Clinical Study of the Skull. Washington, Smithsonian Inst. 79 p. 8¢.
BLACKMAR, F. W. Spanish Colonization in the Southwest. Baltimore, Johns Hopkins Univ. 79 p. 8¢. 50 cents.
BLOXAM, C. L. Chemistry, Inorganic and Organic. 7th ed. Ed. by J. M. Thomson and A. G. Bloxam. Philadelphia, Blakiston. 799 p. 8¢.
CHECKLEV, E. A Natural Method of Physical Training. Brooklyn, N.Y., William C. Bryant & Co. 152 p. 16¢. \$1.50.
CURTMAN, C. O. Uses, Tests for Purity and Preparation of Chemical Reagents employed in Qualitative, Quantitative, Volumetric, Docimastic, Microscopic and Petrographic Analysis. St. Louis, Mo., J. L. Boland Book & Stationery Co. 256 p. 12¢.
GRAY, J. Electrical Influence Machines. London, Whittaker & Co.; New York, Van Nostrand. 237 p. 16¢. \$1.75.
GURNEY, J. H., Jun., and RUSSELL, C. The House Sparrow. The English Sparrow in America, by Elliott Coues. London, William Wesley & Son. 70 p. 12¢.
KAPP, G. Electric Transmission of Energy. 2d ed. London, Whittaker & Co.; New York, Van Nostrand. 348 p. 12¢. \$3.
KUNZ, G. F. Gems and Precious Stones of North America. New York, Scientific Publ. Co. 336 p. 4¢. \$10.
LAING, S. Modern Science and Modern Thought. Parts I. and II. New York, Humboldt Publ. Co. 187 p. 8¢. 45 cents.
LEE, A. B. The Microtome's Vade-Mecum. 2d ed. Philadelphia, Blakiston. 413 p. 8¢.
MILL, J. S. Utilitarianism. New York, Humboldt Publ. Co. 57 p. 8¢. 15 cents.
MUIR, T. The Theory of Determinants in the Historical Order of its Development. Part I. Determinants in General. London and New York, Macmillan. 278 p. 8¢.
RAMSAY, A. C., and others. Upon the Origin of Alpine and Italian Lakes and upon Glacial Erosion. Parts I. and II. New York, Humboldt Publ. Co. 148 p. 8¢. 45 cents.
RITCHIE, D. G., and HUXLEY, T. H. Darwinism and Politics, and Administrative Nihilism. New York, Humboldt Publ. Co. 55 p. 8¢. 15 cents.
SCHAEFFLE, A. Quintessence of Socialism. Tr. by Bernard Bosanquet, M.A. New York, Humboldt Publ. Co. 55 p. 8¢. 15 cents.

FOR SEASON'S STUDY IN

NATURAL HISTORY. Books on *Birds, Insects, Mosses, Lichens, Algæ, Desmids, Sea Life, Spiders, Butterflies, Botany, Microscope, Histology, Bacteria, Zoölogy and Natural History.*

** For sale at all Bookstores, or Catalogue on application to

BRADLEE WHIDDEN, Publisher,
18 Arch street, Boston.

HEAVEN AND HELL. By EMANUEL SWEDENBORG. 416 pages, paper cover. Mailed pre-paid for 14 Cents in stamps by the American Swedenborg Printing and Publishing Society, 20 Cooper Union, N. Y. City.

BOOKS 50,000 vols. of ancient and modern rare and scarce books offered for sale. Send for books tried to obtain elsewhere without success. American, British, German and French Books. Catalogues mailed free to Bookbuyers.

C. N. CASPAR, Book Emporium, 437 E. W. St., Milwaukee

THE LITERARY WORLD.

A fortnightly journal of Literary Criticism, News, and Discussion. *The Literary World*, now in its 21st volume, is the oldest as it is confessedly the foremost journal of the purely literary criticism in the United States. It stands without a rival, and challenges comparison with any other publication in the country, occupying to any extent the same field. Avoiding mere smartness and sensationalism, its aim is to be truthful, just, kind, impartial, appreciative, and helpful to what is best in literature; to instruct, entertain and guide; and to form the taste of the people in literature for what is good, true and beautiful. Published by E. H. HAMES & CO., 1 Somerset St., Boston, Mass.

SECOND EDITION.

NATURALISTIC PHOTOGRAPHY
FOR STUDENTS OF THE ART.

313 pages 8vo., cloth, \$2.00, postage prepaid. "This book contains a greater amount of information on the artistic elements to be considered in photography than any that we know of."—*Scientific American*. Descriptive circulars on application to E. & F. N. SPON, 12 Cortlandt St., New York.

FACT AND THEORY PAPERS.

A series of monographs on scientific matters of general interest.

Ready May 10.

SUPPRESSION OF CONSUMPTION.

By G. W. HAMBLETON, M.D., President of the Polytechnic Physical Development Society of Great Britain. 12°. 40 cents.

Ready May 24.

THE SOCIETY AND THE "FAD."

By APPLETON MORGAN, Esq., President of the New York Shakespeare Society. 12°. 20 cents.

In Preparation.

The Cherokees in Pre-Columbian Times.
By CYRUS THOMAS of the Bureau of Ethnology.

Tornadoes.

By H. A. HAZEN of the U. S. Signal Office.

Foods and Food Adulterants.

By EDGAR RICHARDS, Ex-president National Chemical Society.

Color in Nature.

By G. BROWN GOODE and others.

Protoplasm and the Cell Doctrine.

By C. F. COX, President New York Microscopic Society.

N. D. C. HODGES, 47 Lafayette Pl., New York.

— Kossuth has nearly ready for publication three additional volumes of his memoirs. They are said to contain, among other things, his remarks upon the policy of Napoleon III. toward the Vienna Court, and upon the endeavors of the Pope to retain his secular power.

— "Midnight Talks at the Club" is the title of a volume shortly to be published by Fords, Howard, & Hulbert. It is made up chiefly of a series of articles under the same title from the Sunday issues of the *New York Times*, which excited a good deal of interest when they first appeared, and of an article entitled "A Protest against Dogma," by the same author, Amos K. Fiske, which attracted much attention in a recent number of *The Forum*. These papers contain free and candid discussions of various religious, social, political, and moral questions that interest thinking people of the present day.

INDUSTRIAL NOTES.

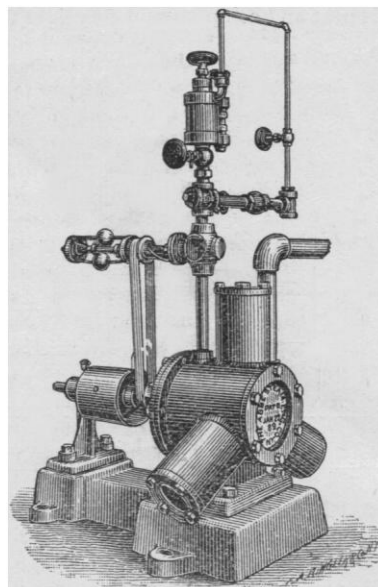
The Abbe High-Speed Steam-Engine.

A STEAM-ENGINE of novel design is shown in the accompanying illustrations. It is of the three cylinder type, and is being introduced to the notice of power users by the Abbe Steam Engine Company of this city. The cylinders are arranged around a central crank-chamber, equidistant from each other. The pistons, which are single-acting, are connected direct to the crank-pin, the piston itself acting as a cross-head, and a simple device being provided for taking up all wear or lost motion at the crank-pin and connecting-rod.

The inner bearing of the crank-shaft is located in a partition separating the crank-chamber from the valve-chamber. In this partition are also located the steam and exhaust passages leading to and from the cylinders. The valve, which revolves with the crank-shaft, is at the back of this partition, being so balanced

that there is just sufficient excess of steam-pressure on one side to keep it up to its seat without undue friction.

To provide for thorough lubrication of all working parts in the crank-chamber, a quantity of oil is placed in the lower part of the chamber, each revolution of the crank distributing it to all



parts. The valve and valve-chamber are lubricated in the usual manner by oil carried in by the steam.

As the engine has no dead centre, it can be started with the crank in any position; and as the cylinders take steam only at one end, the connecting-rods are always in compression; so that,



Children

always

Enjoy It.

SCOTT'S EMULSION

of pure Cod Liver Oil with Hypophosphites of Lime and Soda is almost as palatable as milk.

Children enjoy it rather than otherwise. A MARVELLOUS FLESH PRODUCER it is indeed, and the little lads and lassies who take cold easily, may be fortified against a cough that might prove serious, by taking Scott's Emulsion after their meals during the winter season.

Beware of substitutions and imitations.

Old and Rare Books.

Back numbers Atlantic, Century, Harper and Scribner, 10 cents per copy, other magazines equally low. Send for a catalogue.

A. S. CLARK,

Bookseller,

34 Park Row, New York City.

BACK NUMBERS and complete sets of leading Magazines. Rates low. AM. MAG. EXCHANGE, Schenectady, N.Y.

A New Method of Treating Disease.

HOSPITAL REMEDIES.

What are they? There is a new departure in the treatment of disease. It consists in the collection of the specifics used by noted specialists of Europe and America, and bringing them within the reach of all. For instance, the treatment pursued by special physicians who treat indigestion, stomach and liver troubles only, was obtained and prepared. The treatment of other physicians celebrated for curing catarrh was procured, and so on till these incompatible cures now include disease of the lungs, kidneys, female weakness, rheumatism and nervous debility.

This new method of "one remedy for one disease" must appeal to the common sense of all sufferers, many of whom have experienced the ill effects, and thoroughly realize the absurdity of the claims of Patent Medicines which are guaranteed to cure every ill out of a single bottle, and the use of which, as statistics prove, has ruined more stomachs than alcohol. A circular describing these new remedies is sent free on receipt of stamp to pay postage by Hospital Remedy Company, Toronto, Canada, sole proprietors.

MINERALS

Cabinet Specimens and Collections.

When in New York do not fail to visit our New York store. On account of our very large stock we are able to keep there as well as in Philadelphia a very fine selection of choice Mineral Specimens. Send for Complete Catalogue, Free.

GEO. L. ENGLISH & CO., Dealers in Minerals,
1512 Chestnut St., Philadelphia.
739 & 741 Broadway, New York.

JUST PUBLISHED.

POPULAR MANUAL OF VISIBLE SPEECH AND VOCAL PHYSIOLOGY.

For use in Colleges and Normal Schools. Price 50 cents. Sent free by post by

N. D. C. HODGES, 47 Lafayette Place, New York

DESTROYS COOKING ODORS, and PURIFIES ALL PLAGUE SPOTS.

W. R. Hudson, Esq., of Roslindale, Mass., writes:

"I have thoroughly tested the Sherman 'King' Vaporizer in my house. It is an invention of great value. One of its greatest achievements is the absolute destruction of cooking odors, which it never fails to do, if doors and windows are closed. It purifies all plague spots in and about my house."

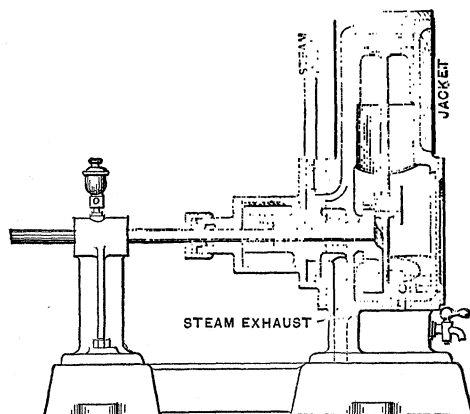


SELF-ACTING. Each Vaporizer sold charged for use. No care except to replenish once in two months at expense of 4 to 8 cents, according to size. Three sizes, \$3.50, \$5.00, \$8.00.

Illustrated Pamphlet free to all. Address SHERMAN "KING" VAPORIZER COMPANY, Chicopee Falls, Mass.; Boston, New York, Philadelphia, or Chicago.

even at the highest speeds, there can be no sudden irregularities of pressure or pounding upon the crank-pin. The working parts being incased, they are exempt from the extra wear induced by the accumulation and grinding-in of dust and dirt.

The engine of this type now on exhibition at the company's office in this city is neat and compact, and very light for the amount



of power claimed. It should be admirably adapted for running dynamos, ventilating-fans, hoisting-engines, and similar machinery requiring high speed; and for boat and yacht engines it should find a wide application, a special valve-gear for reversing being provided, making it available for that purpose.

The Loomis Electric System.

THE Eureka Electric Company (Loomis system), whose ingenious self-regulating system of electric lighting was described and illustrated in these columns about a year ago, have installed many important plants during the past few months. One of their most

recent contracts is one for an installation of two thousand incandescent and several low-tension arc lamps for a large hotel at Tampa, Fla. A notable feature of this installation is the fact that current for both kinds of lamps will be supplied from the same dynamos. Another feature of this installation is that each bedroom in the hotel is furnished with a special incandescent night-lamp, which can be kept burning all night, and at any degree of brilliancy desired by the occupant of the room.

The engines, boilers, and dynamos are placed in a separate building situated some distance from the hotel. The boilers have a total capacity of 250 horse-power, and supply steam to two automatic high-speed engines of 110 horse-power each. These furnish power for four dynamos of five hundred lights each. The main switch is of special design, and controls all the lights, both arc and incandescent. It is so constructed that the dynamos can be run singly, in pairs, or in multiple, any desired combination being made in a moment. Four main circuits run from the dynamo building to the hotel through an underground conduit. Each circuit is provided with an ammeter and a ground detector, and each is connected, by a compound switch, with a voltmeter; so that the electro-motive force of all, or of any one, or of any combination of dynamos, may be quickly taken. As a whole, the installation is expected to be the principal electrical feature of Tampa.

The Eureka Company have also installed a plant at Duncansville, Penn., one-half the output of the dynamos being used for arc lamps, the other for incandescent. They have also recently put in plants, incandescent or mixed, in Hollidaysburg, Penn.; Wakefield, Mass.; Paterson, N.J.; Bloomfield, N.J.; Marcellus, N.Y.; West New York, N.J.; Portland, Ore.; Little Falls, N.Y.; Chester, Penn.; Pinkney, Tenn.; and quite a number of large plants in important business buildings in this city. The growth of their business has been so rapid and constant, that the company have been compelled to remove their factory from this city to larger and more convenient quarters in Brooklyn.

NO OTHER Life Policies as liberal cost as little money, no others as cheap give as much for the money, as those of

THE TRAVELERS

OF HARTFORD, CONN.

Best either for Family Protection or Investment of Savings, non-forfeitable, world-wide, lowest cash rate.

Assets, January 1, 1890,	-	-	-	-	-	-	\$11,528,649 30
Liabilities,	-	-	-	-	-	-	9,163,115 24
SURPLUS,	-	-	-	-	-	-	\$2,365,534 05

Chief Accident Company of the World, only large one in America. Covers Accidents of

TRAVEL, SPORT, OR BUSINESS

All around the Globe.

Paid Policy-holders \$17,500,000.

Over \$1,500,000 of it in 1889.

JAS. G. BATTERSON, President.

RODNEY DENNIS, Secretary.

JOHN E. MORRIS, Asst. Secretary.